

29. (amended) The structure of claim 25, wherein said at least one first doped area comprises a p-type impurity.

30. (amended) The structure of claim 25, wherein said at least one first doped area comprises an n-type impurity.

31. (amended) The structure of claim 25, wherein said substantially dopant-free, uninterrupted diffusion barrier layer is silicon nitride.

32. (amended) The structure of claim 25, wherein said substantially dopant-free, uninterrupted diffusion barrier layer is silicon oxynitride.

REMARKS

Applicants note the mailing of a Supplemental Information Disclosure Statement, a completed Form PTO-1449, and a copy of the reference cited in the Supplemental Information Disclosure Statement on June 11, 1999. Applicants respectfully request that the Supplemental Information Disclosure Statement and Form PTO-1449 be considered and made of record. If the Examiner has not yet received the Supplemental Information Disclosure Statement, the Form PTO-1449, or the copy of the reference cited in the Supplemental Information Disclosure Statement, applicants will hand deliver copies of these documents to the Examiner at the Examiner's request.

Applicants further note that the status of claim 32 was not noted in the Office Action mailed May 24, 1999. Clarification regarding the status of claim 32 is respectfully requested.

The Office Action mailed May 24, 1999 (hereinafter "the Office Action"), has been received and reviewed. Applicants affirm their provisional election without traverse to prosecute the invention of Group I, claims 25-32. Claims 1-24 have been withdrawn from further consideration as being drawn to a non-elected invention. Claims 25-32 are currently pending in

the application. Claims 25-31 stand rejected. Applicants have amended claims 25-32, and applicants respectfully request reconsideration of the application as amended herein.

Rejections Under 35 U.S.C. § 102

Claims 25, 26 and 29-31 stand rejected under 35 U.S.C. § 102(e) (hereinafter "Section 102(e)") as being anticipated by U.S. Patent 5,688,719 issued to Lu et al. (hereinafter "the Lu patent"). In order for a reference to be anticipatory under Section 102(e), however, it "must teach every aspect of the claimed invention either explicitly or impliedly." *M.P.E.P.* § 706.02. Thus, "[a]ny feature not directly taught [by the reference] must be inherently present." *Id.* In the instant case, the Lu patent does not explicitly or impliedly teach every aspect of claims 25, 26 and 29-31. Consequently, applicants respectfully traverse the rejection of these claims under Section 102(e) and request that the rejection be withdrawn.

Amended claim 25 recites "[a] pre-anneal intermediate structure in the formation of an isolation structure for a semiconductor device" which includes "a substantially dopant-free, uninterrupted diffusion barrier layer over said at least one first doped area on said substrate first surface." The Lu patent, however, does not explicitly or impliedly teach these limitations.

The Lu patent teaches and claims a method of creating a semiconductor substrate with twin wells isolated by field oxidation. During the method taught by the Lu Patent a semiconductor substrate having first and second sides is coated on its first side with an oxide layer followed by a nitride layer (col. 2, lines 45-55, FIG. 1). Unlike the substantially dopant-free, uninterrupted diffusion barrier layer recited in claim 25, however, the nitride layer taught by the Lu patent is necessarily contaminated with dopants and partially etched before at least one first doped area is created on the semiconductor substrate.

The nitride layer taught by the Lu patent is deposited before n-wells and p-wells are created on the semiconductor substrate (col. 3, lines 5-59, FIG. 1 - FIG. 6). The method of the Lu patent requires that the dopants used to create the n-wells and p-wells be implanted through the nitride layer (col. 3, lines 64-67, FIG. 1 - FIG. 6). Thus, the nitride layer is necessarily contaminated with dopants before any doped areas are created on the substrate and before any annealing or

"thermal drive-in" step takes place (col. 3, lines 6-33, FIG. 5 & FIG. 6). Additionally, before the dopants which form the p-wells and n-wells can be implanted, the nitride layer must be etched and partially removed (col. 2, lines 60-64, FIG. 3 - FIG. 6). Thus, the Lu patent does not explicitly or impliedly teach a pre-anneal intermediate semiconductor structure having at least one doped area on its first surface and a substantially dopant-free, uninterrupted diffusion barrier layer over the at least one first doped area. Consequently, applicants submit that the Lu patent does not anticipate the subject matter recited in claim 25, as it is amended, and applicants respectfully request that the rejection of claim 25 under Section 102(e) be withdrawn.

The fact that the diffusion barrier layer recited in claim 25 is both dopant-free and uninterrupted is also significant. Depositing a continuous and substantially dopant-free diffusion barrier layer over the doped areas on the first surface of the semiconductor substrate after implantation the doped areas, but before annealing, virtually eliminates the potential for contamination of the first surface due to out-diffusion of contaminants during the annealing process.

In contrast, a nitride layer which is contaminated with dopants or compromised by etching, stripping, or other removal techniques can not serve as effectively as a diffusion barrier layer. If the supposed diffusion barrier layer is contaminated, the contaminating dopants will likely out-diffuse during an annealing step, resulting in a high risk of contamination of other intermediate semiconductor structures within the processing chamber. This is also true if the supposed diffusion barrier layer is compromised. Wherever the diffusion barrier is etched, removed or otherwise compromised, contaminants can also out-diffuse during an annealing step leading to contamination of other intermediate semiconductor structures within the processing chamber. Thus, a substantially dopant-free, uninterrupted diffusion barrier layer enjoys significant functional advantages over a diffusion barrier layer which is contaminated or compromised during the creation of doped areas on the semiconductor substrate surface.

Claims 26 and 29-31 depend from claim 25, and claims 26 and 29-31 incorporate all the limitations of claim 25. Consequently, the pre-anneal intermediate structure recited in each of

claims 26 and 29-31 includes a substantially dopant-free, uninterrupted diffusion barrier layer over the at least one first doped area on the first surface of a semiconductor substrate. As was detailed in relation to claim 25, the Lu patent does not explicitly or impliedly teach a structure having these limitations. Therefore, applicants respectfully submit that the Lu patent does not anticipate claims 26 and 29-31, and applicants respectfully request that the rejection of these claims under Section 102(e) be withdrawn.

Rejections Under 35 U.S.C. § 103(a)

Claims 27 and 28 stand rejected under 35 U.S.C. § 103(a) (hereinafter "Section 103") as being unpatentable over the Lu patent as applied to claims 25, 26 and 29-31 above, and further in view of Mathews et al. (U.S. Patent No. 5,837,378) (hereinafter "the Mathews patent"). However, the combination of the Lu Patent with the Mathews patent does not establish a *prima facie* case of obviousness against claims 27 and 28, and applicants respectfully traverse this rejection.

As is set forth in M.P.E.P. § 706.02(j), a *prima facie* case of obviousness under Section 103 can not be established unless three basic criteria are met.

First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

The combination of the Lu patent with the Mathews patent does not teach or suggest all of the limitations of claim 27 or claim 28, and, therefore, the combination does not support a *prima facie* case of obviousness.

Both of claims 27 and 28 depend from claim 25. As dependent claims, claims 27 and 28 incorporate all of the limitations and elements recited in claim 25. As already discussed, claim 25 recites "[a] pre-anneal intermediate structure in the formation of an isolation structure for a

semiconductor device" which includes "a substantially dopant-free, uninterrupted diffusion barrier layer over said at least one first doped area on said substrate first surface." Thus, the structures recited in claims 27 and 28 also include these same limitations.

The combination of the Lu patent with the Mathews patent, however, does not teach or suggest a pre-anneal intermediate structure including a substantially dopant-free, uninterrupted diffusion barrier layer over the at least one first doped area on the substrate's first surface. As has been discussed in relation to the rejection under Section 102(e), the Lu patent contains no such teaching or suggestion. Instead, the Lu patent teaches the deposition of a nitride layer **before** any p-well, n-well, or doped area is created in the semiconductor substrate. The nitride layer of the Lu patent, however, is contaminated with dopants and partially removed before any doped areas are created on the semiconductor substrate surface. Therefore, the teachings of the Lu patent would only teach or suggest a pre-anneal intermediate structure having a contaminated, interrupted or compromised nitride layer over doped areas created on a semiconductor substrate.

Moreover, the teachings of the Mathews patent do nothing to remedy the deficiencies of the Lu patent. The Mathews patent teaches a method of reducing stress-induced defects in silicon. During the course of the process taught by the Mathews patent, an intermediate structure is created which includes a "masking stack" (an oxide layer and a nitride layer) on both the top and bottom surfaces of a silicon wafer. However, the Mathews patent does not teach or suggest an intermediate structure including a masking stack on both the top and bottom surfaces of a silicon wafer having at least one first doped area on the top surface. In fact, in order for the method of the Mathews patent to work effectively, the masking stack on the bottom side of the silicon wafer is removed before any further processing occurs (col. 2, lines 15-22, col. 5, lines 31-41, and col. 6, Lines 12-16). Thus, the Mathews patent does not teach or suggest an intermediate structure as is claimed in claims 27 and 28.

It is stated in the Office Action that "it would have been obvious to one having ordinary skill in the art . . . to form the barrier layer 154b over second surface of the substrate 1 of Lu as taught by Mathews because nitride on the second surface reduces overall stress on the wafer thus prevent[ing] warpage" (Office Action, page 4). This assertion, however, does not take into

account that the intermediate structure of the Lu patent does not include a substantially dopant-free, uninterrupted diffusion barrier layer over at least one doped area. Furthermore, this assertion ignores the fact that the Mathews patent teaches only a method for reducing stress while forming a field oxide pattern on a semiconductor substrate **before** any doping of the semiconductor substrate is performed. Thus, the teachings of the Mathews patent combined with the teachings of the Lu patent do not teach or suggest a pre-anneal intermediate structure with a substantially dopant-free, diffusion barrier layer on the first or second surface of a semiconductor substrate having at least one doped area on its first surface, and applicants respectfully request that the rejection of claims 27 and 28 under Section 103 be withdrawn.

Entry of Amendments

The amendments to the drawings, to the specification, and to claims 25-32 included herein should be entered by the Examiner. In accordance with 37 C.F.R. § 1.115, these amendments are presented for entry after the first Office Action and before any final action. Further, the amendments are supported by the as-filed specification and drawings and do not add any new matter to the application. Finally, the amendments do not raise new issues or require a further search.

Conclusion

Claims 25-32 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicants' undersigned agent.

Respectfully Submitted,



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